Technical Paper Series 5

BRITISH COLUMBIA Heritage Trust

Trees and Towns

Technical Paper Series 5

Trees and Towns

Heritage Conservation Branch
Province of British Columbia
February 1983

Canadian Cataloguing in Publication Data

Harper, Dave.
Trees and towns

(Technical paper series / British Columbia Heritage Trust, ISSN 0229-9976 ; 5)

"Prepared by Dave Harper, Marshall Macklin Monaghan, on contract with the Heritage Conservation Branch"--p.
Bibliography: p.
ISBN 0-7719-9147-9

1. Trees in cities. 2. Historic trees. I. British Columbia. Heritage Conservation Branch. II. British Columbia Heritage Trust. III. Title. IV. Series: Technical paper series (British Columbia Heritage Trust) ; no. 5.

SB436.H37 715'.2 C83-092072-2

Acknowledgements

This paper was prepared by David E. Harper, M.C.I.P., Senior Planner with Marshall Macklin Monaghan, on contract with the Heritage Conservation Branch, Province of British Columbia. He has worked as a municipal planner in British Columbia and as a consultant to other levels of government and the private sector. Mr. Harper has been actively involved in tree protection programs and in identifying tree related problems particularly as they apply to urban areas. Mr. Harper has a Bachelor of Arts from the University of California and completed a Masters of Geography at the University of Toronto.

Photos were provided by Clive Justice, the District of Saanich and Marshall Macklin Monaghan.

Table of Contents

Foreword 1
Introduction 3

1. Roles of Trees in Communities 5
2. Causes of Tree Loss 9
3. Protecting Community Trees 13
4. Developing a Tree Program 24
5.Costs of a Tree Program 26
6. Get Started 27
7. Summary 28

Appendix A: Tree Evaluation 28
Appendix B: Heritage Tree Registration Procedure 29
Appendix C: Tree Inventories 29
Appendix D: Tree Protection Policies 30

Glossary 31
Bibliography 32

Titles already published in this series:

Bradshaw, J., *Heritage Conservation in British Columbia: A Selected Bibliography*, 1979.

Collier, R., *Guidelines for Restoring Brick Masonry*, 1981.

Patterson, R.M., *Manual for the Preparation of "As Found" Drawings*, 1982.

Collier, R., *Guidelines for Storefronts of Heritage Buildings*, 1982.

All technical papers are available at a charge of five dollars a copy.

Copies may be requested from:

British Columbia Heritage Trust
Parliament Buildings
Victoria, B.C.
V8V 1X4

Foreword

Since its inception in 1977, the British Columbia Heritage Trust has been developing new ways to "support, encourage and facilitate the conservation, maintenance and restoration of heritage property in the Province." One is the Publications Assistance Program which provides aid for production costs of publications dealing with B.C. history. In addition, the Trust has inaugurated this Technical Paper Series.

Although a great deal of general information on heritage subjects is already available, there has been a growing request for concise treatment of specialized subjects within the British Columbia context. Themes are therefore drawn from the fields of history, archaeology, architecture and preservation technology. The British Columbia Heritage Trust invites suggestions for further studies in this series.

Martin Segger
Series Editor

Introduction

This paper is written for local government officials and staff, developers, architects, urban designers and members of the general public. Its purpose is to outline the roles of trees in urban and suburban environments, the main causes of tree loss, and most importantly, what methods are available to create and maintain attractive community treescapes. To assemble the information, public officials and staff were surveyed, people involved in arboriculture and urban forestry were contacted, and available literature and legislation were studied.

Recognizing that trees are an integral part of the heritage and character of our communities, the Heritage Conservation Branch of the Provincial government undertook this study to encourage the conservation of this valuable resource. As with other community heritage resources, the responsibility to implement appropriate and effective programs to protect trees rests largely with local government. It is hoped that this guide will help municipalities and regional districts to realize the wide range of opportunities available to them for tree protection.

Legal, procedural and financial tools are available for dealing with most tree problems. This paper attempts to clarify some of the confusion surrounding tree protection techniques, and acts as a guide to preparing and implementing effective tree protection, planting and maintenance programs.

Several broad categories of trees are discussed in this paper. Community trees are any trees growing in or near a town or city. Heritage trees are those which have special public significance because of their history, size or species. Street trees or boulevard trees grow in public rights-of-way near roads. Private or public trees are distinguished by ownership of the land on which they grow.

This twin-trunked Arbutus adds not only beauty and character to this frame bungalow, but several thousand dollars in value as well.

1. Roles of Trees in Communities

The full range of contributions by trees to British Columbia communities is rarely considered. As with many amenities, trees are often taken for granted until they are lost or threatened; then their importance to our lives suddenly becomes clear.

That vegetation is vital to a healthy, attractive community seems intuitively obvious to tree lovers, but such feelings are of little help in preparing programs, budgets and cost-benefit analyses. The values of trees to the economy, the environment and pleasantness of our towns must be understood to justify undertaking a tree program.

Environmental Values

Environmental quality is enhanced by trees. Trees improve climate and air quality, and moderate annual and daily temperature extremes. Plants absorb heat during the day and release it at night, and deciduous trees provide cooling summer shade and transmit warming winter sun. Shelter belts of trees act as wind breaks, impede drifting snow and filter water droplets from the air in fog-prone areas. Moisture evaporating from leaves humidifies surrounding air. Studies have shown that trees effectively remove air-borne pollutants by absorbing such unpleasant gases as sulphur dioxide (SO_2) and ozone (O_3), and by trapping dust and other particulate matter. The small but significant net production of oxygen (O_2) by plants is important to humans and other animals.

Trees stabilize the land with their roots, which bind together soil particles and hold them against erosion by wind and water. This erosion-control function is especially important on steep slopes, and on banks of lakes, streams and marine shores. Vegetation can be as effective as engineering works in minimizing erosion, and is attractive, inexpensive, and requires relatively little maintenance.

Trees help to retain rain and snow on land and to slow runoff. By holding winter precipitation for slow release throughout summer, treed areas act as "sponges" to reduce both flooding and droughts. Water is purified and cooled by filtration through roots and soil, a process which benefits water quality and fisheries, and reduces the need for drainage works.

Trees provide food and shelter for many species of birds and wildlife, and generally provide their only habitats in urban settings. Birds and small animals add interest and quality to our lives, and give balance to urban ecosystems through the control of insects and other pests.

Aesthetic Quality

Trees contribute substantially to the visual character of a community. Not only are trees attractive in their own rights, but they can enhance the beauty of buildings as well, by emphasizing or softening building lines. The trees growing around a heritage building may have a history as interesting as that of the building, and form a part of the heritage site. Trees perform important design functions by framing and creating views and vistas, defining space and enclosing areas. Stately mature trees lining a boulevard can compose the most attractive and memorable portion of urban streetscapes. Street trees and shrubs serve to buffer residences from the noise, glare and unpleasantness of traffic. Tree forms, particularly when one kind of tree is used to border a street (monolithic planting), give a coherent appearance to the area, even where adjacent building styles and finishes may be incompatible.

Trees screen unattractive sites and separate conflicting land uses, such as residential and industrial developments. Planted along roads and around parking lots, trees and shrubs disperse noise, absorb pollutants, reduce dust, and screen headlights and street lights.

Trees can define both place and time in a most beautiful manner. The geographic location of a community is often described by the types of trees which grow there and by seasonal changes in their appearance. The profusion of blossoms on ornamental and fruit-bearing trees heralds the spring. The street over-hung by stark, bare branches during winter becomes in summer a leaf-shaded avenue under a green canopy. The fire of fall colours can lift the spirit during the waning of the year. In the depths of winter, the snow-clad boughs of conifers add Christmas-card beauty to many British Columbia communities.

This pleasing mix of trees provides a variety of colours, forms and textures on this flat site.

These flowering and coniferous trees attractively buffer adjacent homes from this thoroughfare.

The depth and variety added to this streetscape by these young chestnuts will only increase with time.

These boulevard trees soften the lines and add interest to this commercial street, making it more attractive to shoppers.

Economic Value

That trees are economically valuable is indisputable, but how to measure their value is subject to a wide range of interpretations. As lumber, trees have a substantial dollar value determined by a complex market mechanism.

At a nursery, trees have a definite value, generally referred to as replacement cost, which reflects the cost of breeding, raising, marketing and sometimes planting the trees. But community trees have other values which can be considerable, though difficult to calculate. In addition to their environmental and aesthetic contributions, trees add economic value to the surrounding areas, as well as being valuable in themselves.

Trees can make commercial areas more attractive to shoppers. Tree-lined streets in central business districts or landscaped shopping malls are more appealing than barren sidewalks and plazas, as business people are well aware. The attractiveness of a town for residential and business purposes is enhanced by the presence of trees.

On residential properties, treed lots sell for more than equivalent properties without trees, as every realtor knows. A regression analysis of assessed values of homes in suburban Manchester, Connecticut, in 1980 indicated that well-treed properties sold for at least six per cent more than properties with poor tree cover (Morales, 1980). Other studies have shown property value increases of 15 to 18 per cent, based solely upon the presence of trees. In the evaluation standards of the International Society of Arboriculture (an organization fostering scientific tree management and education), "average residential and landscape trees" are second only to heritage trees in value.

The value of individual trees to property owners can be calculated. According to accepted standards of the International Society of Arboriculture, the basic or maximum value of an average tree is $2.79 per square centimetre ($18 per square inch) of trunk area. This means that a tree in perfect condition with a diameter of 30 cm (12 inches) could be worth as much as $2,000. The basic value is adjusted by percentage values for type of tree, condition and location. Heritage trees, for example, have a location value of 90 to 100 per cent of the basic value, while dense forest trees rate 10 to 20 per cent. The factors applied in evaluating trees are complex, and tree evaluation should be undertaken only by trained people. A summary of the method of calculation is found in Appendix A. For trees which are obtainable at nurseries (generally trees less than 30 cm (12 in.) in diameter), replacement value is based on purchase price and planting costs.

Trees contribute to the capital value of communities. It has been estimated that every 2,500 trees planted add approximately $1 million to the capital value of the community. Although such values are not convertible into cash, they represent an investment which justifies care and maintenance. The street trees in the City of Vancouver have an estimated replacement value of $50 million. A formal tree inventory in the District of Saanich (population 80,000) suggested that each of the 45,000 boulevard trees in that community had an average value of $363 in 1977, and a total estimated value in the urbanized area in excess of $18 million. Whereas increased assessments may have only a nominal effect on an individual's property taxes, municipal officials should recognize the positive implications of community-wide tree-enhanced values on assessments and revenues.

Trees can reduce building heating or air-conditioning costs substantially. One study (Urban Forestry Conference, 1978) showed savings of 10 per cent ($45 to 100 annually) on home heating bills if trees were planted around the house to reduce heat loss and wind chill. Similar savings were realized on air-conditioning costs by shade tree plantings on the buildings' south sides. Another estimate of savings for a house with complete tree protection is 34 per cent on electric heat, 50 per cent on air conditioning (Neuman, 1979).

These striking street trees contribute value to adjacent properties, complement private trees and beautify this residential streetscape.

Community Character

Because native trees reflect the climate and soil conditions prevalent in that area, the vegetation growing in a community is often as distinctive as the community itself. Trees, therefore, constitute one of the primary contributors to the character, visual heritage and quality of a community. Some kinds of trees in the communities of Nelson and Revelstoke, for instance, are found nowhere else in those regions. Recognizing and protecting these special trees can be considered as important as protecting heritage buildings.

Many new communities in British Columbia have not been established long enough to have heritage trees. The selection and protection of notable tree specimens, even as the community is being built, will provide heritage trees for the future. Planting trees to mark special occasions will provide future generations with links to the past. For example, the coronation of King George VI was commemorated by the planting of trees throughout the Commonwealth. Every coronation tree was listed in a register (published in 1939), including those planted in 25 British Columbia communities.

Citizens are generally supportive of tree protection and planting programs. In the *Goals for Vancouver* questionnaire, 80 per cent of respondents placed a high value on landscaping and greenery. The psychological benefits of living in treed areas have been well documented (Ulrich, 1980).

Planting trees shows concern for the future of a community. Trees, with lifespans many times longer than a human's, add a sense of continuity and permanence to communities. A well-treed town shows caring and civic pride, concern for tomorrow, and respect for the land and nature's bounty. Conversely, avoidable loss or removal of trees not only has immediate negative effects, but is also a loss to our children and their children.

2. Causes of Tree Loss

Without fencing protection or trenching guidelines, this tree faces certain damage and probable death.

Despite their value, trees are cut or killed for a variety of reasons, which must be understood if actions to minimize tree loss are to be effective. Some tree removals are necessary and unavoidable, but many are not. The whole community benefits when trees are saved from unnecessary destruction.

Development

The major reason for removal of community trees is urban development. In growing communities, the bulk of new development occurs on raw land, on sites frequently covered by trees. Re-development of aging neighbourhoods in established communities takes a large toll of heritage trees.

Subdivision and re-development plans, road alignments, utility corridors and even building sites frequently are prepared without considering the characteristics of the site. Thousands of mature trees are lost unnecessarily because they are not considered an important design factor. Fortunately, the "bulldoze first, landscape later" syndrome is less prevalent today than in years past.

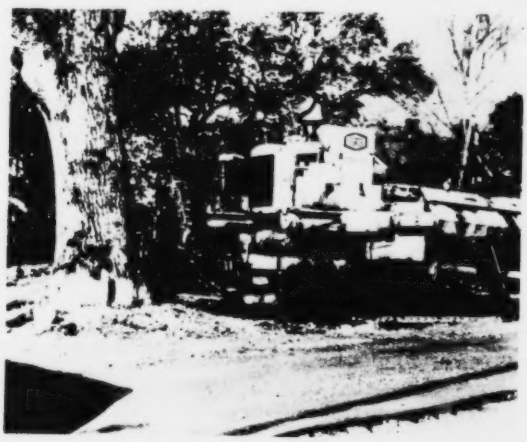
Even if a development is designed to retain trees, site clearance crews, builders and utility installers often are not told to save the trees, or are not penalized if trees are damaged. Changing soil levels by making cuts or fills as small as 10 cm (4 inches) near the trunk is sufficient to kill some trees. Grade reductions or road or foundation excavations which cut tree roots are also harmful.

One of the greatest tree killers is soil compaction. The tiny spaces between soil particles (called interstitial pore spaces) are necessary for roots to breathe and absorb water and nutrients. Running trucks and construction machinery over trees' root zones compacts the soil, essentially suffocating the trees. Piling fill

and debris or parking vehicles on the root zone can have the same compacting effect.

Trees growing in natural settings have beneath them an "understory" of shrubs and grasses. Removal of this understory changes soil temperature and moisture, and can kill a tree slowly. Death often takes three to seven years. Douglas Fir, Grand Fir, Western Hemlock, Western Red Cedar and Maple are among trees most sensitive to understory clearing.

Even if trees have survived design, construction and landscaping hazards, the dangers are not ended. Home owners desiring less shade, a garden, a bigger lawn, a better view, fewer leaves to rake, fuel for the wood stove or just something on which to use the new chain saw can reduce to cord wood in a few hours a tree which may have taken 200 years to grow. The frustration expressed by developers and builders who tried to save only to lose them when the home sells, is understandable.



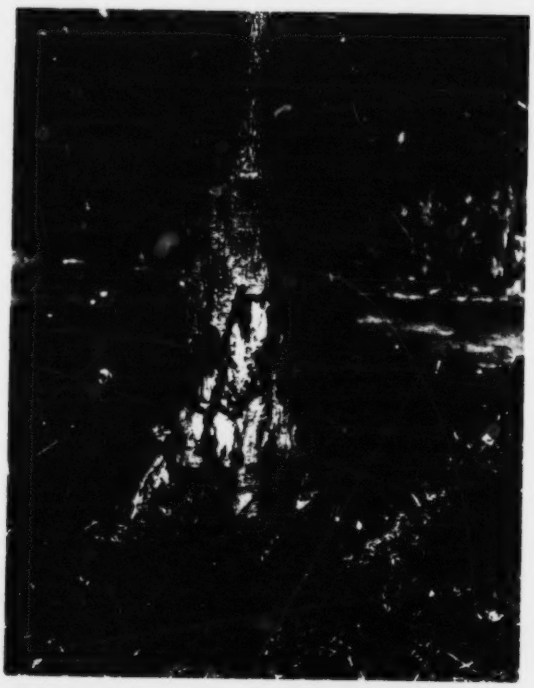
Parking a hot asphalt machine on this public boulevard guarantees root damage to this mature oak.

Unprotected trees are subject to broken boughs and root compaction from fill and construction debris.

Complete removal of understory plants in this new prestigious development will cause slow decline and eventual death of these firs.

Logging

The British Columbia economy is based upon the forest industry, and logging is a valued tradition. In suburban areas, the distinction is blurred between forest trees suitable for logging and community trees to be valued for other reasons. The trees on some suburban lots are viewed as a standing asset to be cut to help pay the mortgage. The profit from logging is quickly realized, whereas financial gains from preserving the trees, such as higher sales values and lower landscaping costs, are not as easily calculated.



Vehicle-caused bark damage interrupts nutrient and water flows and, unless treated, provides an entry point for disease and insects.

Urban Conditions

Trees, like people, suffer from harmful urban conditions. Air pollution takes its toll of certain species of trees, especially adjacent to heavily-travelled roads. Pollution from smelters is notorious for its lethal effects on surrounding vegetation. Vandalism is a major cause of mortality among newly-planted trees, mainly those near school grounds or taverns. Cramped roots, soil compaction and pavement all make survival difficult. Urban trees are also subjected to assaults from chemicals, such as pesticides, and petroleum products. Winter road salting damages both roots and foliage, reducing nutrient uptake and photosynthetic capacity. By the time salt damage is evident, it is sometimes too late to save the tree. In light of all of these hazards, it is a wonder that trees survive as well as they do in urban settings.

In established communities, trees are removed for reasons of maintenance. Disease and old age are common reasons for tree removal. View protection causes many trees to be heavily pruned, topped or even removed, as well as causing substantial animosity among neighbours.

Many trees are removed because they are thought to be dangerous. Although the occasional falling bough or tree does damage property, such occurrences are relatively rare. Judicious pruning is generally sufficient to protect property. Education can reduce the fear.

Installing and maintaining utilities damages many trees. Poor pruning practices can render street trees unsightly and unbalanced, sometimes necessitating tree removal. Many utility line clearance contracts are awarded to the lowest-bidding firm, a practice which does not guarantee selection of the company best qualified to perform this skilled operation. Installation and maintenance of underground services damage many tree roots and necessitate some tree removals.

Amazingly, this urban tree was butchered to prevent its branches from crossing property lines.

Government Organization

To be successful, tree protection and maintenance depend upon all departments and staff of local government working together. In many municipalities and regional districts, however, the responsibility for trees is split between engineering, parks, building inspection, public works and planning departments. The mandates of these departments differ, as do their approaches to trees. Without a clear strong statement of tree protection policies and responsibilities from the political level, the tree resource suffers from lack of understanding and management. Trees are assets in the same sense as sewers or roads; their care should not be left to chance nor jeopardized by poor communication and cooperation.

Pests

The various caterpillars, loopers, beetles, rusts, scales and other insects and diseases which live on trees are seldom fatal to the trees, but can become nuisances. In epidemic proportions some infestations, such as Dutch Elm disease and Spruce bud worm, can destroy trees. But even defoliating insects, such as oak loopers, rarely kill the trees. Often pest populations are cyclic, and even problem pests disappear after a few seasons.

Trees weakened by bark damage, pollution or root compaction have increased susceptibility to attacks from pests. Whereas a healthy tree can often survive a moderate level of infestation, a weakened tree cannot.

3. Protecting Community Trees

Given the number of threats to community trees, it is fortunate that there is a variety of ways to protect trees and assure green communities in the future. Four broad areas of tree protective action are available: public involvement and education, development control, municipal programs, and regulation.

Public Involvement and Education

If every citizen understood the value of trees, how they grow and what trees need, little further action to protect trees would be necessary. Education can generate awareness of trees, followed by understanding of their value and requirements. This appreciation will cause people to protect and preserve trees.

A model school program developed by landscape architect Clive Justice is being conducted at Hammond Elementary School in the Maple Ridge School District. Grade 4 pupils aged 9 to 11 years are each given a tree to care for during the school year. The children learn the names and origins of their trees. They keep a journal of observations and tree measurements, and care for the trees. At the end of the year, each tree is passed on in a ceremony to an upcoming Grade 4 pupil. Vandalism of these trees is almost nonexistent, an area is enhanced by trees and gradually a generation of tree protectors is formed.

School districts should be encouraged to develop such "hands on" tree education programs. The curriculum could dovetail nicely with introductory biology and even history courses. In the United States, Arbor Day, an annual event first celebrated in 1872, is recognized as a day to plant and learn about trees. Canadian schools could take advantage of the teaching materials and programs prepared for Arbor Day.

A two-way education and communication process should extend beyond schools, because successful tree programs rely upon broad public support. Residents should understand tree planting, maintenance and protection measures. Their comments, ideas and criticisms should be actively sought, because there are many knowledgeable people in the community who can make valuable contributions to tree programs. Knowledgeable writers preparing tree-related articles for local newspapers can stimulate significant local interest.

Street-planting programs, especially, profit from "personalization" of the trees. In New Westminster, cards are sent to residents, asking them to water newly-planted trees in front of their houses. Public input can be elicited by newspaper notices, inserts in water bills or tax notices, posters, door-to-door surveys or other measures which may be locally effective. In order that discussion, rather than just presentation, can occur, meetings with interested residents are useful, with slide presentations and workshops to convey information on trees. If local cable television stations are available, phone-in programs can be aired to facilitate public discussion.

Any public involvement program is incomplete if it does not include service clubs and other interested groups. Some organizations, such as the Victoria Horticultural Society, have been leaders in identifying heritage trees and in encouraging their protection. Appendix B outlines the procedure used by the Society to identify heritage trees. Special program funding may be obtained from service clubs and organizations. Ratepayer groups in specific neighbourhoods have become involved in tree programs in Canada and elsewhere. Service clubs and other organizations often will participate in tree-planting events which make use of volunteer labour.

These boulevard trees contribute to the attractiveness of this busy street for thousands of motorists daily.

Tree protection is advocated by a number of groups organized to achieve specific goals. The Pacific Northwest Chapter of the International Society of Arboriculture deals with all aspects of tree husbandry and protection. The British Columbia Society of Landscape Architects registers its members, who provide advice on preservation and care of trees and the environment. In the United States, the National Arbor Day Foundation organizes Arbor Day activities and the American Forestry Association's Big Tree Program maintains a register of the biggest trees of each species. The Men of the Trees is an international society encouraging tree protection.

Development Control

Some trees will always be lost to development, but it is possible to reduce the amount of unnecessary tree removal so that developers, home buyers and the public benefit. The first step in preserving trees on developing sites is for trees to be recognized as being valid items for consideration during reviews of development applications. Clear direction from councils is essential to insure the preservation of trees within development areas.

The best opportunity for retaining trees on development sites is to consider them in the pre-design stage. A survey of the vegetation on the site should be conducted by a qualified arborist or landscape architect, with the size and species of trees accurately plotted on a site plan. Some municipalities already require trees and contours to be shown on plans accompanying development applications. Local government staff members familiar with trees should inspect the site with the developer and discuss building locations, utility corridors, materials storage areas and how best to fit the development to the site. **Figure 1** shows one type of planting plan.

On major projects, developers should retain a qualified arborist/landscape architect even before design work begins. Fees for early professional involvement and project supervision are offset by savings on plant materials, landscaping and long-term maintenance, as well as by a more attractive, marketable final product. Trees are biologically complex, and to maximize survival they should be cared for by a qualified professional.

Local governments can assist developers by preparing and distributing standards and guidelines for tree protection. Although the standards will vary from place to place, the following items should be included:

- landscape plans - show all trees over 15 cm (6 in.) in diameter
- utility installation - alignments, trenching methods
- material and equipment storage, vehicle parking - designate areas
- barricading of mature trees - sturdy fencing outside of drip line
- grade changes - elevation, location/type of wells or retaining walls
- maintenance - root and branch pruning, watering and fertilizing schedules
- methods available for varying zoning/ subdivision/building by-law requirements for tree protection.

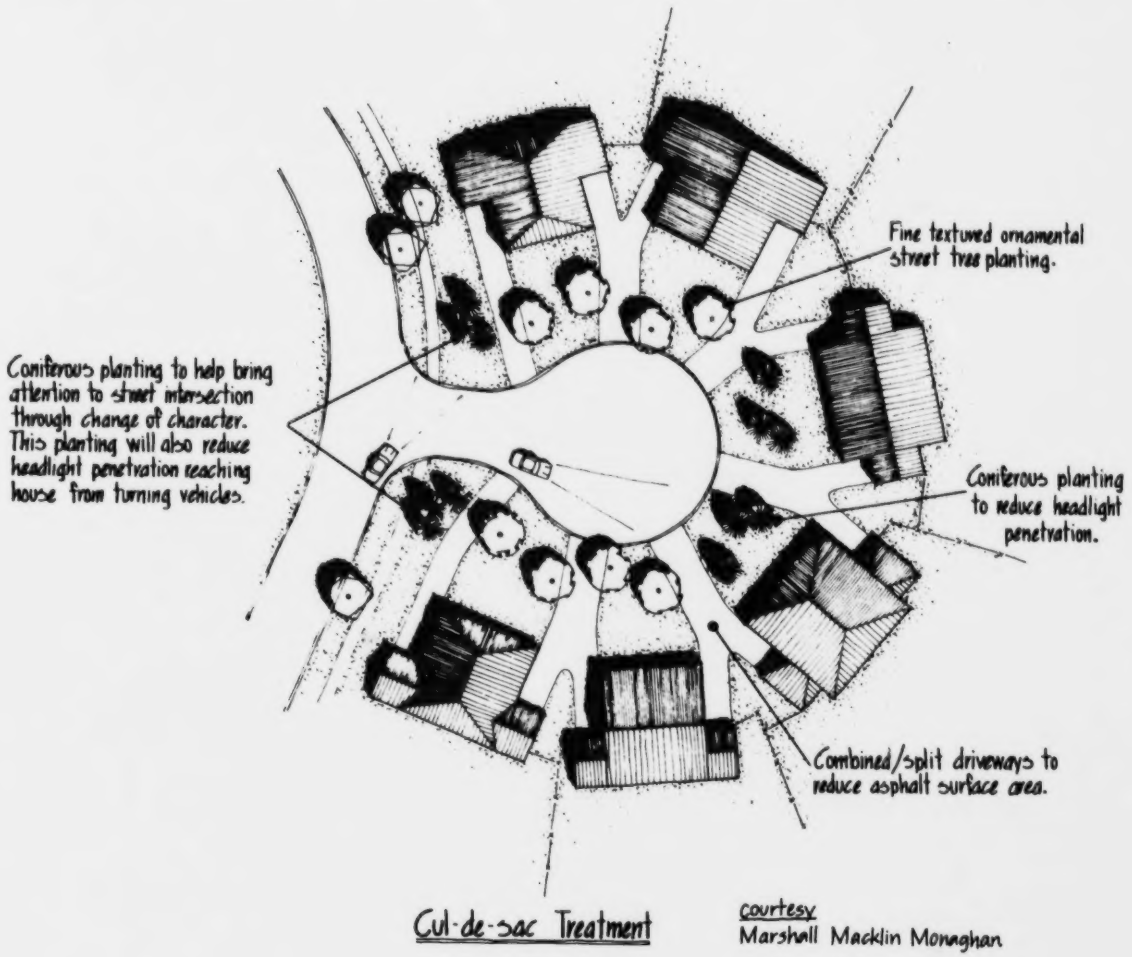

Fine textured ornamental street tree planting.
Coniferous planting to help bring attention to street intersection through change of character. This planting will also reduce headlight penetration reaching house from turning vehicles.
Coniferous planting to reduce headlight penetration.
Combined/split driveways to reduce asphalt surface area.
Cul-de-sac Treatment
courtesy
Marshall Macklin Monaghan

Figure 1
Street Tree Planting Plan.
This actual development concept shows one way in which street planting plans can be presented for review by local government.

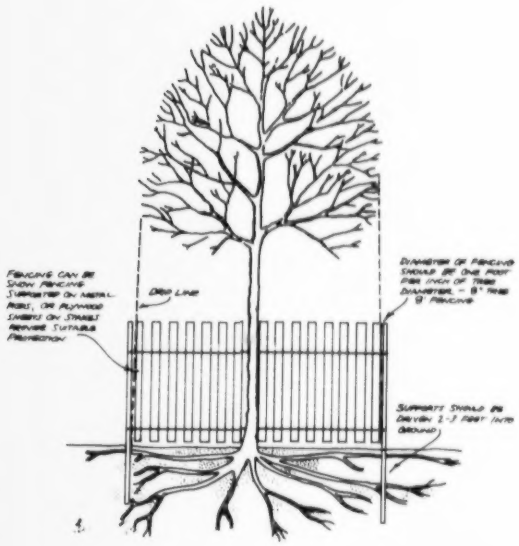


Figure 2
Tree Protection during Construction.
Temporary fencing installed around trees before site work begins protects trees from machinery damage, excavation or deposit of fill, material storage and vehicle parking, thereby improving their chance of survival.

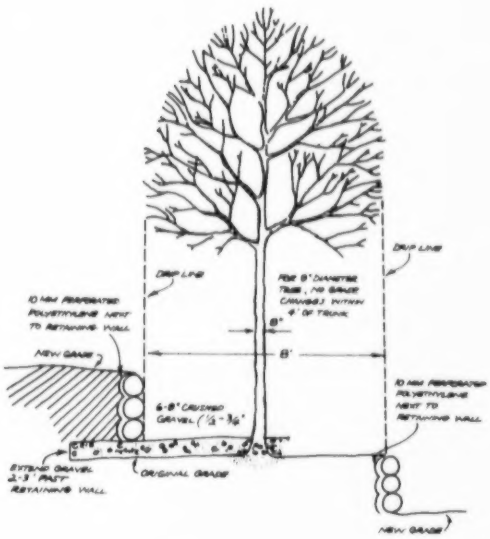


Figure 3
Grade Changes around Trees.
Ground levels can be changed safely around mature trees if the proper procedures are followed.

The details of the requirements should be developed by an arborist in close consultation with the local government. **Figures 2** and **3** show the types of tree protection guidelines which can be distributed to developers and builders.

During site clearance, trees to be saved should be clearly marked. On extensive sites, a clearing firm familiar with selective logging should be used, and should receive instructions from the developer regarding tree protection. A monetary bond or a penalty clause for non-performance written into the clearing firm's contract can be persuasive in assuring compliance with tree protection goals. Building contractors should understand tree protection requirements. Foremen should know where to store equipment, when to tunnel under roots, when to call for an arborist and even where to park their vehicles. The workers implement the plans and policies prepared by others; they should understand what is expected and why.

The developer should budget for and begin tree care at the start of the project. Maintenance should continue after construction to help established trees over the shock of development and to ensure survival of newly-planted trees.

Local Government Tree Program

Programs to protect trees in British Columbia municipalities and regional districts range from inaction to elaborate combinations of policies, education and legislation. Communities concerned about their appearance and livability should develop a tree program adequate to ensure a healthy treescape for present and future generations.

Street Trees

Street tree planting and maintenance programs are common in British Columbia, though most programs could be improved. Some types of trees are more suited than others to city conditions. Street tree plantings should be based upon a list of trees suitable for local requirements. Planting appropriate trees reduces pruning, pests, leaf clean-up and sidewalk heaving by roots; minimizes conflicts

with aerial utilities; and lends coherence to streetscapes. Older, established cities, such as Vancouver, are now faced with substantial street tree maintenance costs because trees with undesirable characteristics (such as fast growth) were planted decades ago. Too often, surplus nursery stock obtained at reduced prices is planted rather than using appropriate quality material. Planting correct types of street trees can result in substantial long-term savings in maintenance dollars.

To look their best and remain healthy, community trees require maintenance. To maximize the return on maintenance dollars, as well as to better understand the tree resource, a tree inventory is highly desirable. A tree inventory involves knowledgeable people surveying street and park trees, noting species, condition, location and need for maintenance. Coding this information and, if available, computerization, provide a means for quick and effective maintenance scheduling. The inventory must be kept current as tree maintenance, removal and planting is done. Examples of inventory data are found in Appendix C.

Utility Line Clearance

Utility line clearance involves pruning of parts of trees which conflict with power lines, cable television, telephone or electrified overhead bus lines, street lighting standards or underground services. The sensitivity of some of the pruning which is done often is less than optimal.

Discussion and voluntary agreement have proven fairly effective in reducing the severity of the damage. Some municipalities, in consultation with the utility companies, have drafted utility line clearance guidelines for use by clearance crews. These guidelines can establish pruning standards and techniques, a permit system and inspection procedures. Such guidelines are voluntarily followed. It is also possible for municipalities, as in the case of the City of Vancouver, to contract to perform line clearance for utility companies. Such an arrangement allows quality control and pruning of the entire tree, which results in lower unit costs.

Three methods are available for reducing the need for utility line clearance. First, undergrounding of utilities makes branch pruning unnecessary, though initial root pruning may be required. Utility conduits should be sealed against roots. The Power Line Beautification Fund Act provides cost sharing for undergrounding of Hydro lines. A less expensive method is to locate aerial lines in rear lanes rather than on front streets. This approach merely relocates the problem, though damage to street trees is normally minimized and the clutter of lines is eliminated from streetscapes. Finally, planting low-growing and slow-growing trees in boulevards means that pruning for line clearance is rarely, if ever, needed. A street tree list of approved species can eliminate this problem in the future, and aid replanting efforts in neighbourhoods which already have large boulevard trees.

Local governments have few legal rights in dealing with B.C. Hydro. Section 44 of the B.C. Hydro and Power Authority Act gives Hydro, its crews or subcontractors the right to enter on any land and cut down any trees which they think might endanger Hydro property or obstruct the running of survey lines, with or without the owner's approval. Within communities, Hydro is fairly sympathetic to concerns about line clearance.

Proper pruning creates a branch pattern which is attractive and balanced.

Tree Committees

It is not unusual for local governments to establish citizens' committees to deal with tree-related issues. Oakville, Ontario, has an effective joint public/staff/Council committee of eight members dealing with tree programs, public awareness, inter-group liaison and legislation. Tree removal issues are frequently referred to the tree committee for recommendations.

Local governments which have Advisory Planning Commissions or Advisory Design Panels can use these bodies to review tree-related issues. Authorized under Sections 715 and 816 of the Municipal Act, Advisory Planning Commissions could have responsibility for tree protection on developing lands included in their establishing bylaws. The Advisory Planning Commission in the District of North Saanich regularly reviews tree protection techniques. The Advisory Design Panel is a related body established by some municipalities to review appearance and landscaping components of development applications. Tree protection, replanting and maintenance are vital to creating attractive developments.

Both Planning Commissions and Design Panels could actively participate in preparing maintenance programs, utility line clearance guidelines, official plan policies related to trees, and information packages for the public and developers. Because members of these advisory groups are residents of the community, they can provide valuable public input into tree programs. They can also ensure that trees are considered as part of overall development evaluations.

Local Heritage Advisory Committees can be formed under Section 15 of the Heritage Conservation Act to provide advice to municipal Councils on heritage matters. Heritage tree protection certainly falls within the Committees' scope of responsibility. Heritage Committees in several municipalities have undertaken to inventory heritage or landmark trees, and some have taken steps to protect those trees. In Summerland, for example, the Heritage Advisory Committee posted identifying markers on heritage trees.

Trees and Views

For people who have bought homes with spectacular views, the growth of obscuring trees can be a major annoyance. In the debate over pruning versus removal to preserve views, feuds between neighbours are common, with local governments often drawn into the fray. The issue is further complicated because the trees involved are often on slopes or near water bodies, where their removal can cause erosion and bank instability.

The District of West Vancouver has developed an effective procedure for dealing with trees versus views problems. The issue has been thoroughly and publicly discussed to educate local residents. Where a problem exists with a public tree, surrounding home owners are surveyed to determine whether they want the tree pruned, removed or left alone. If pruning or removal is favoured by the majority of residents, the municipality does the work at the expense of the complainer. Tree topping is discouraged as it disfigures the tree and can cause top breakage, blow down, decay and bushy new growth. West Vancouver has also prepared and published *The Tree Book*, listing and showing low-growing and slow-growing trees. Cooperation between neighbours is encouraged to deal with the problem in a positive manner.

Moving Large Trees

Trees are generally considered permanent, stationary objects, and most desirably, they should be. However, if road widening, development or other actions threaten trees, equipment and expertise is available to transplant trees quickly and safely. Tree moving can be done with tree spades (hydraulic scoops which quickly lift, move and replant trees), by excavation and boxing, or even by helicopter. Tree spades can move trees up to 47 cm (18 inches) in diameter. Tree moving is a delicate and costly arboricultural task, and should be undertaken only by experienced firms.

Local governments can facilitate tree moving by making permanent sites available onto which trees can be moved. Such areas include golf courses, parks or gardens which become, in effect, arboretums. Also, government personnel and equipment can be used to aid developers or others to move trees on a contract basis, in exchange for the trees, or *gratis*. Public works and engineering departments should tell developers about tree moving, and mark trees which should be moved before road widening, utility installation or development begins.

Moving this 10-metre conifer requires a combination of hand work and heavy equipment, but results in instant landscaping for large institutional buildings.

Urban Forests

An approach common in Europe but fairly rare in Canadian cities and towns is the creation of an urban forest. An urban forest is a large tract of treed land, such as a watershed, which is used for recreation and sometimes for selective logging. An urban forest can be publicly owned as in the case of Vancouver's Stanley Park and University Endowment Lands, or a combination of parks and private land, such as the Highlands of Vancouver Island's Capital Regional District. The land use regulations and tree protection measures used on private lands obviously differ substantially from those applicable to parks. Nonetheless, designation of an area as urban forest indicates a political intention to retain the forest character and to encourage multiple use of the forest, including optimizing recreational access by urban residents.

Pest Control

The control of pests is a difficult aspect of tree management. Although some biological controls exist for a small number of pests, spraying trees with pesticides is the most common method of treatment. Extreme care must be used when spraying in neighbourhoods. Even if they are used with care, some residents are opposed to any use of pesticides. Others want the pests eliminated at any cost, and a third group of residents is apathetic. The conflicting views of these groups must be considered a valid component of pest management decisions. The effects of pest control programs on the residents — as well as the pests — should be predicted before the program is implemented.

The difficulties encountered in dealing with epidemic pest problems sometimes can be avoided by early identification of infestations. An adequate tree maintenance program can provide the basis for systematic monitoring of tree health.

An urban forest provides an uplifting yet humbling respite from city life.

Regulation

Knowledge and voluntary cooperation are the best ways to preserve trees; however, stronger measures are sometimes needed. Local governments have recourse to legal regulations to protect trees for the sake of the community as a whole. The following chart presents a summary of available legal tools and their areas of applicability. No single action deals with all tree issues. A tree program should apply those regulatory approaches which deal with local conditions.

Use of Regulations

	Private Trees	Site Clearance	Suburban Logging	Landscape Plans	Setback Relaxation
Heritage Designation	X	X	X		
Covenants & Easements	X	X	X		
Zoning Bylaw				X	
Subdivision Bylaw		X		X	
Board of Variance					X
Development Permits				X	X
Official Plans		X	X	X	X
Policy Statements	X	X	X	X	X

Community and Settlement Plans

Municipalities and Regional Districts are empowered to prepare official community and settlement plans under Sections 711 and 809, respectively, of the Municipal Act. Such official plans establish policies to guide future development, including protection of areas of natural or historical interest. It is appropriate to include in official plans objectives dealing with tree protection. Some examples of policies contained in official plans are found in Appendix D.

Subdivision Bylaw

Local government subdivision bylaws regulate the size, shape and servicing of newly-created parcels of land. In administering the subdivision bylaw, the appointed Approving Officer under Section 729 of the Municipal Act, ". . . shall give regard to any official community plan" in evaluating applications. Hence an Approving Officer may require a subdivision to comply with the tree protection policies in an official plan.

A subdivider may be required to provide, without compensation, land for public open space and/or a 7-metre-wide strip bordering water bodies, providing the area does not exceed 5 per cent of the land being subdivided. These provisions could be used to protect areas of fine trees from loss during development.

An Approving Officer can refuse a subdivision on the grounds of harm to the public interest, to established amenities or the environment. In the case of Kahl vs. the District of Oak Bay, Mr. Justice Berger ruled that the Approving Officer acted within his rights in rejecting a subdivision application because trees would be cut. Removal of the trees necessitated by development of the subdivided property would injuriously affect established amenities of adjoining or adjacent properties. This opinion of the Approving Officer was supported by a survey of nearby residents. It should be noted, however, that in the absence of a tree cutting bylaw the property owner could legally cut every tree, thereby eliminating the established amenities, without proceeding with the subdivision.

Zoning Bylaw

A zoning bylaw regulates the use of land and the permissable height, bulk and setbacks of buildings. In evaluating applications for rezoning, the local government must consider public health, welfare, amenities, the value of land and the character of the area. Trees contribute to all of these qualities, and therefore warrant consideration during the rezoning process.

Building setbacks established by zoning bylaws are often identified by developers as major impediments to tree protection. Adding flexibility or reducing setback requirements facilitates consideration of trees during siting of buildings.

Cluster housing can preserve more trees on a site than traditional subdivision, without

reducing the number of housing units provided. Cluster housing can be townhouses or detached houses on small lots, surrounded by open space. In either case, the quality and visual appeal of the project often equals or exceeds that of traditional development, as shown on **Figure 4**. Cluster housing generally requires a rezoning and strata titling of the units. The comprehensive nature of the development permits a high degree of developer control over design, siting, finish and landscaping. Hiring a project arborist to manage the trees is often economically justified.

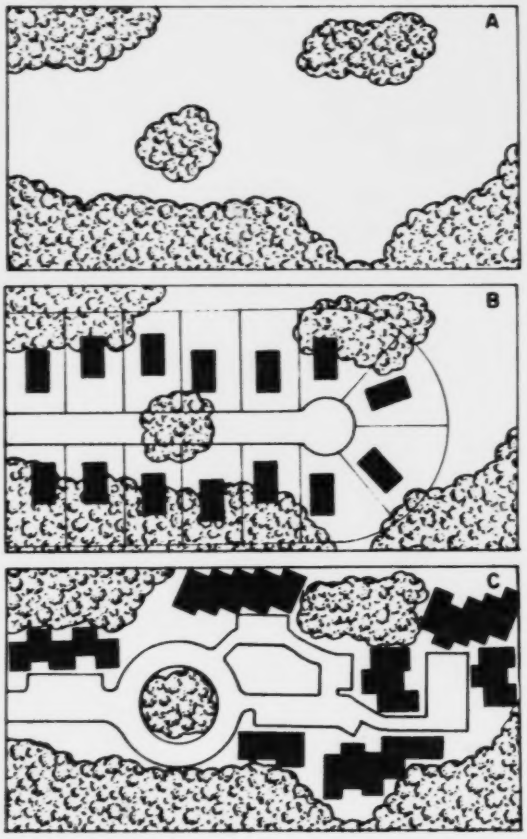


Figure 4
Using Trees in Design.
Considering the nature of the site improves developments and saves trees. This diagram shows how cluster development of 28 townhouses can save all trees on a site, whereas a poorly planned 14-lot subdivision causes the loss of at least one quarter of the trees.

Boards of Variance adjudicate alleged "undue hardship" caused by the zoning bylaw. Under 726 of the Municipal Act, variances must enhance appropriate development of the site. Interpretation of these sections varies among local governments, especially regarding "hardships". A setback relaxation could be requested if zoning requirements would cause unnecessary loss of trees, on the grounds that the loss of value and attractiveness of the trees is a hardship. Getting support from neighbours would improve the chances of obtaining a variance. **Figure 5** shows how varying setbacks can save trees on a lot.

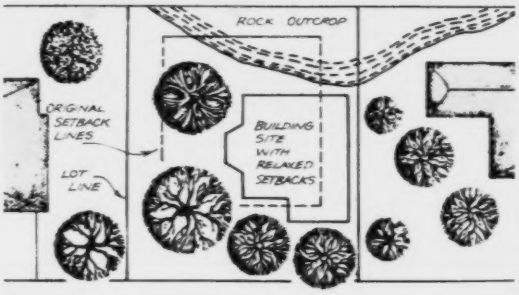


Figure 5
Setback Relaxation.
Relaxing building setback requirements allowed better utilization of this site, saving two trees which otherwise would have been lost and still avoiding the rock outcrop.

Development Permits

Trees can be protected on developing sites by development permits. Under Section 717 of the Municipal Act, development permits can vary provisions of the zoning bylaw to better the environment, achieve community goals and provide open space. Permits can vary siting and dimensions of buildings, require landscaping, regulate construction and require dedication of land for open space. A performance bond can be required to assure that terms of the permit have been met.

Issuance of development permits can be on a voluntary or a required basis. Permits can be required only in designated development permit areas, in which "special conditions prevail in the physical environment." Lands having fine stands of trees should be designated development permit areas to encourage recognition of the trees' value. Designation would give the local government added discretion in approving development proposals based on the effect on trees.

Heritage Designation

Trees with heritage value can receive certain protection under provisions of the Heritage Conservation Act. The Provincial Cabinet or Municipal Councils can apply the Act to create heritage designations. Trees identified as "heritage" under procedures explained in Appendix B could be justified as candidates for designation under the Heritage Conservation Act.

The Cabinet may designate land as a heritage site or personal property as a heritage object, and provide substantial protection for those sites or objects. Trees may be designated heritage by the Cabinet under this section of the Act. Provincial designation prohibits any action which would deliberately "alter" the tree without permission of the Provincial Secretary.

Cutting or other abuse of the heritage tree therefore would be regulated. By provincial policy, such protection would only be applied to a tree of demonstrated "provincial significance." For instance, near Osoyoos, twin trees "entwined by Indians at the time of the survey of the International Border" were designated heritage objects by Cabinet in 1955. If designation of a tree causes loss of economic value of the land, compensation may be required to be given to the property owner.

Municipalities have more limited powers than the Cabinet under the Heritage Conservation Act. Municipal heritage designation applies only to demolition, alteration or construction of buildings and structures. Therefore, if a municipality designates a tree (or more precisely, the land upon which the tree stands), its owner could, without violating the Heritage Conservation Act, cut down or purposely kill the tree. There is nothing in the Act to specifically prevent cutting of a heritage tree from a heritage site. However, because it is the land which is designated, construction could continue to be regulated on the heritage site even if the heritage tree has been cut.

Section 544 of the Municipal Act states that a council is required to compensate an owner or tenant for any loss of economic value resulting from its actions. It is conceivable that heritage tree designation could lower property values if it would restrict the development potential of a site, in which case the possible requirement of compensation should be considered.

This heritage Garry Oak grows on a suburban site slated for shopping centre development. Will it survive?

Covenants and Easements

A contractual method of protecting trees is to register a restrictive covenant on a property, preventing the cutting of a tree or trees. A covenant is a written agreement under which a property owner accepts conditions on the use of the land, such as restrictions on the right to cut a tree. Once registered, covenants run with the property, and bind all future owners, unless the covenant is extinguished by mutual consent. Covenants can protect individual trees on private property, a very useful tree protection tool. Covenants can be "positive", requiring some action, or "negative", prohibiting an action. Positive covenants are sometimes called easements. Covenants prepared under Part 3 of the Heritage Conservation Act (rather than under the Land Title Act) can be monitored and enforced by non-government agencies such as tree committees or heritage groups.

Covenants have some significant limitations. Property owners must agree to the covenant, and people unsympathetic to tree protection may not cooperate. Because a covenant is a contract, the property owner may expect compensation, such as cash, tree maintenance

or any other benefit. If maintenance is a condition of the contract, access to the tree may be assured by wording in the covenant or by a separate easement. The time involved in negotiating and registering covenants can be reduced by protecting notable trees on large parcels before subdivision increases the number of owners.

Other Legislation

Several other legal methods may be used to protect trees. Traffic or parks bylaws may include clauses protecting public trees. For instance, the Township of Esquimalt's Traffic Bylaw states:

No person shall at any time destroy, damage or injure any tree, shrub, flower, foliage, grass or other growing thing upon any boulevard.

Such bylaws also may require owners to maintain boulevards, provide a basis for prosecution of street tree vandals, and establish responsibility for public trees.

Watershed and ravine protection legislation can protect trees. The Stream Conservation Bylaw of the Okanagan Basin Water Board specifies that within five metres of any stream:

Removal or disturbance of vegetation, soils, or parent material is prohibited without a permit.

Such regulations recognize the importance of trees in purifying and retaining water and in controlling erosion.

Local governments often have vegetation control bylaws dealing with unsafe or diseased trees or shrubs. Owners of trees or shrubs posing hazards to health or property are required to correct the problem. Otherwise, the government may do the work at the expense of the property owner.

Powers granted to regional districts differ from those of municipalities. Regional districts lack authority to designate heritage sites. Development regulation through zoning and subdivision bylaws is not identical to that of municipalities. Even if regional districts lack direct legislative authority, much can be accomplished by encouraging constituent municipalities to adopt tree protection policies, programs and legislation.

Tree Cutting By-laws

Until recently, municipalities were empowered to regulate tree cutting under Section 930(f) of the Municipal Act. However, on July 24, 1981, that enabling section was repealed; this means that tree cutting on private property no longer can be regulated by municipalities.

In newly developed areas, tree programs should emphasize street tree plantings and protection of existing trees.

4. Developing a Tree Program

A Council or Regional Board, upon recognizing the value of heritage and community trees, should take steps toward establishing a program to preserve and enhance the tree resource. A tree program is an organized body of information, plans and procedures for creating and maintaining a treed community.

An eight-step approach is suggested for preparing a tree program:

- identify resources and issues
- establish goals, objectives and policies
- designate staff
- prepare an action plan
- prepare a budget
- execute, and
- review the program.

Each step will be explained briefly.

Identify Resources and Issues

A community's tree resource and the issues related to its use, loss and improvement must be identified accurately if the tree program is to be effective. Numbers and types of public and private trees should be catalogued, as should major causes of tree loss. Rare or unique species growing in the area should receive special consideration. Soils and drainage should be part of this description. The value of the tree resource should be explained. Contributions to the economy, environment and appearance of the community should receive attention. Tree programs have an improved chance of success if the value of the trees is clearly stated.

Establish Goals, Objectives, and Policies

Goals should be formulated to make clear a vision of a desirable future and to deal with current problems. Objectives establish steps to achieve the goals, and policies state actions to be taken. Goals, objectives and policies may be prepared by staff, an advisory committee or a consultant, but in any case, they must be endorsed at the political level. Establishing goals, objectives and policies provide direction for other parts of the tree program, and enable the public, politicians, government staff and developers to understand the intent and direction of the tree program.

Designate Staff

As with any program, the tree program will be no better than the people involved in it. It is critical, therefore, to carefully assign the tasks and the responsibilities involved. The first task is to determine who presently has responsibility for trees: the parks director? the engineer? the planner? the clerk? no one? Overlapping or conflicting responsibilities must be identified. Programs generally function best when a single person (or department) has responsibility for all tree-related issues: planting, maintenance and removal. This approach eliminates wasteful conflicts over authority, and clearly establishes a contact person for information or action. The responsible person should have training and experience in arboriculture, resource management, public relations and program development.

Tree committees, if established, will bear some responsibility for tree program content and direction. However, daily program administration and technical decisions are more efficiently conducted by a staff member.

Public works and parks crews should have a working knowledge of tree care. Planting, pruning, fertilization, watering, and pest identification and treatment are necessary job skills of those who come into contact with trees. In-house training programs can be run by the

tree program manager or by consultants. The benefits of crew training and periodic upgrading easily justify the modest costs of the programs.

Larger communities should consider hiring an arborist. An arborist would take responsibility for tree management, public information, site visits and consultation with developers, and tree inventories. If a full-time staff arborist cannot be justified, a consulting arborist can provide service when needed on an hourly basis.

Prepare an Action Plan

The action plan or strategy outlines the actual implementation measures which will be used to turn the policies into reality. Existing programs and procedures within the local government should be used whenever possible. By modifying existing procedures for processing development applications, training public works crews, clarifying staff responsibilities and preparing specification sheets for working near trees, trees can be saved in an efficient, low-profile manner. Often it is possible for the tree program manager to co-ordinate existing procedures and programs to encourage a green community with almost no increase in public costs.

At budget times, however, it is useful to have a high-profile, easily-identified tree program which can attract public and political support. High profile programs include public education, boulevard tree planting, heritage tree designation, pruning and often new legislation (such as Official Community Plan content).

A tree program should make good use of resources on hand in the community. Local residents and staff often are most dedicated to making a tree program work. Heritage tree programs, especially, rely upon local knowledge, involvement and commitment to tree protection. Heritage trees of the future can result from Arbor Day plantings, or trees planted by notable people. These types of activities can raise public awareness of heritage trees.

The action plan should always include a public information component. Having strong public support makes achieving the tree program goals easier and more effective, and helps to generate political commitment to the program. The public information program should convey not only tree protection suggestions, but also should promote the local government tree program by describing its content and rationale and urging public support.

The tree program need not apply uniformly to all areas of the community. Rather, it should be tailored to fit localized conditions and problems. In neighbourhoods where mature trees are common in front yards, there is little justification for a boulevard tree program. Conversely, if development is occurring in treeless areas, a planting program has more relevance than protection.

Prepare a Budget

A tree program always generates some costs, and the budget expresses the needs of the program in very real terms. The size of the budget must be based upon an assessment of:

- the political support for the program
- the financial situation of the local government and
- cost sharing methods available.

Chapter 5 of this booklet explores tree program costs in more detail.

Execute

With the preceding phases of the tree program in place, execution of the program should follow efficiently. It will be useful to have completion dates assigned to the various stages of the plan, as a measure of progress. This work schedule should be endorsed at the political level. Resistance to tree programs is not uncommon from some government staff members, developers and sometimes from the public. This opposition can be overcome by education and persistance, though occasionally some change in program approach is needed.

Review the Tree Program

A tree program must be reviewed periodically to assess its success in achieving stated goals. Among the items for review and revision are:

- the relevance of goals, objectives and policies of the tree program
- efficiency and cost effectiveness of the program
- changes in tree problems, public perceptions
- staffing and training needs and
- changes in financial and political conditions.

Changes to the tree program should be made whenever needed, but a complete program review should be conducted at least every five years.

5. Costs of a Tree Program

The costs of tree protection should be weighed against benefits to the community and the costs of tree replacement.

Considering the benefits to the community of creating and maintaining attractive treescapes, the required public expenditures are small. Nonetheless, a tree program must justify the expenditure of public monies and must make efficient use of funds received.

Tree planting costs vary widely according to costs of materials and labour. Representative costs (1981) of a tree, delivered and planted on site are $50.00 for a 3 cm (1 inch) "whip," and $250.00 for an 8 cm (3 inch) sapling. The plant materials account for approximately one-half of these figures. If the local government operates a nursery, the expense of plant materials may be only a fraction of that of purchasing from private growers. Variables such as locating and avoiding underground services, cutting sidewalks and even replacing excavated soil can significantly affect costs of planting. Local experience will make cost estimation more accurate. Bulk purchases of materials and coordinated planting programs can generate substantial savings. In vandalism prone areas, planting "whips" can be false economy because of their low survival rate. Larger stock is sturdier, and therefore less easily damaged by vandals.

Although tree program budgets can only be prepared accurately using local figures after determining local needs, some general guidelines may be helpful. In the United States, two common standards for tree program funding are $1.00 per capita or $8.00 per tree per year. These are minimum standards, and it has been estimated that an adequate municipal program would cost $1.50 to $2.75 per capita or $10.00 per tree. Inflation and local conditions can render these standards inadequate.

Tree programs rely for most of their funding upon annual local budgets and therefore must have public support. Opinion polls have shown that objections to government spending are

aimed primarily at inefficiency and muddled priorities, not against programs seen to improve the quality of life. It is unlikely that residents would object to a $2.00 per year tax increase to fund an efficiently run, adequately explained tree program.

One of the worst causes of cost inefficiency in tree planting and maintenance is an unclear *ad hoc* approach to tree issues. A well-managed, tightly co-ordinated tree program will eliminate this problem and produce improved results for each dollar spent.

Tree programs are notorious victims of the axe at budget time. The problem often lies with the preparation and presentation of the budget. Whereas more successful budget items (such as public works) have impressively detailed cost calculations, tree budgets tend to be subjective and imprecise. Exact figures on numbers and locations of trees to be planted or pruned, with accurate unit costs, will make tree budgets more defensible. The budget should be presented to the politicians by the tree program manager who can explain and defend it, rather than by a less-than-enthusiastic administrator. The tree program should be presented as an easily identified, well-justified, high-profile budget item. A glamorous program has an improved chance of attracting political support.

Two methods of recovering costs of planting street trees or landscaping local parks are under local improvement bylaws or by specified area charges (Sections 651 and 674, respectively, of the Municipal Act). The local government may assess part or all of the costs of works against the benefitting property owners.

Small communities often are unable to bear the costs of arborists, trained tree crews and equipment needed for maintenance or tree-moving. Several solutions are available. One is sharing among local governments and school districts. By sharing the costs of employees or equipment all communities can enjoy a higher level of tree care than any could singly. The biggest obstacle to sharing is lack of cooperative spirit among local governments and agencies. Another approach is to contract out work to the private sector. Consultants can provide expertise and advice, and landscape/tree service firms can provide labour and equipment needed in tree programs. Using these methods, few communities in the province could not afford a high quality tree program.

6. Get Started

The benefits of an effective tree program — a protected community heritage, visual, environmental, economic enhancement — are well documented. Urban trees can prevent or reduce the alienation from nature common in urban settings and make our communities finer, healthier places to live. Saving and planting trees expresses the highest of human motivations: concern for the future, aesthetic sensitivity, selflessness and care for the community. Trees can transform a town or city from a utilitarian place to work, shop or reside into a pleasing, attractive community warranting pride and personal attachment.

Action is needed to realize the benefits of tree programs. Such action can come from individuals writing letters to aldermen, from politicians proposing a program, from local government staff suggesting procedural changes, from community groups forming tree committees or from dozens of other sources. This paper provides direction for taking action as well as the blueprint and tools for building a tree program. It is now time for action.

7. Summary

Trees enhance economic, environmental and visual conditions in communities. Trees are lost unnecessarily as a result of development, suburban logging, vandalism, urban conditions and other causes. Through a combination of planning, education, planting and regulation, communities can create and maintain attractive treescapes. Formulating and executing a tree program improves tree management efficiency and cost effectiveness and, in light of the benefits, is justified and overdue in many communities. A tree program should be tailored to fit local conditions, and can be integrated with existing local government programs and staff. British Columbia communities will be better, richer places to live if action is taken to plan, plant and protect trees.

Appendix A

Tree Evaluation

This method for calculating tree values has been developed and refined by the International Society of Arboriculture.

Tree evaluation should be conducted by trained personnel, as an accurate value can be calculated only if a number of technical variables are correctly applied. The basic formula is:

Basic Value or **Replacement Cost x Species x Condition x Location = Value**

For 1981, the basic value is $2.79 per square centimetre ($18 per square inch) of trunk area measured 1.3 m (4.5 feet) above the ground. Trunk area is calculated using the formula:

$A = 0.7854 \times d^2$, where A = area
d = diameter

Replacement cost is used for trees under 30 cm (12 inches) in diameter, measured 30 cm (12 inches) above the ground. The cost of replaceable trees is the retail value of the tree. If the species is unobtainable, then the formula is used to calculate value.

Species value is a percentage based upon the hardiness or suitability of the tree for a particular location. Pest resistance, messiness, resistance to snow and ice loading, and pleasing appearance are other factors to be considered. Though some tables are available for certain areas, normally these judgements are based upon local knowledge.

Condition of the tree is a percentage based upon general health, growth rate, freedom from disease, structural problems, and longevity. Ratings range from excellent (90 to 100 per cent) to poor (0 to 20 per cent).

Location is a percentage value, considering the tree's relationship to its surroundings. Some representative values are:

Heritage tree, regionally rare	- 90 to 100 per cent
Average residential landscape tree	- 80 to 90 per cent
City street or boulevard tree	- 60 to 80 per cent
Dense forest tree	- 10 to 40 per cent

Tree evaluation is subject to variation even among experts. Nonetheless, the values established have proven sufficiently accurate to form the basis for settlement of insurance claims and municipal damage assessments.

Source: *Council of Tree and Landscape Appraisers, 1979.*

Appendix B

Heritage Tree Registration Procedure

The following steps are followed by the Victoria Horticultural Society's Heritage Tree Committee in evaluating trees proposed for heritage designation. Trees so designated are placed on a Heritage Tree List, which has strong persuasive value, though it provides no legal protection.

1. Potential heritage trees are brought to the attention of the Heritage Tree Committee by:
   - Committee members
   - interested citizens
   - a tree owner, or
   - a government agency or employee.
2. The tree inventory is reviewed by the Committee's Registrar for previous designation or reserve status.
3. If a new candidate tree, permission for possible designation is sought from owners of private trees. Public trees are not reviewed with the owners at this time.
4. If permission to designate is denied, or if the tree is previously designated, the tree is placed in reserve status. The proposer is so notified.
5. If a candidate for designation, a Committee member (or two) with technical tree expertise surveys the tree. If the tree is in safe condition and in "historical class," a member with historic research expertise visits the owner and other sources of historical information.
6. Available data is reviewed by the Registrar and compared to previously designated trees. Findings are referred to the whole Heritage Tree Committee.
7. After careful review and consideration of the collected data by the whole Heritage Tree Committee, the tree is either designated "heritage" and given a Class (size, landmark, rare, etc.) or is placed in the reserve status.
8. The owner, either private or government agency, is notified and a Heritage Tree Certificate is presented.
9. Whether a private or public tree, the local agency in which the tree is growing is notified in writing and given all particulars for their records.
10. The Heritage Conservation Branch of the Provincial Government is given details for their register.
11. For trees on public property, local news media may be given detailed information for publication.
12. If a previously-designated tree ceases to be a "heritage tree" the owner, the Heritage Conservation Branch and the local government are so notified and the tree may be placed in the reserve status. An unsafe tree may be removed from the register completely.
13. A tree may be removed from status because:
    - it has been removed or severely damaged
    - its condition has deteriorated
    - the original or new owner so requests, or
    - a tree of superior status has been found.
14. Each year, all local government agencies, the Heritage Conservation Branch and owners of trees in designated "heritage areas," ie. Royal Roads, are notified of the continuing status of their trees.

Appendix C

Tree Inventories

The cost of collecting data on community trees was calculated in a Fort Worth, Texas, study as 47¢ (U.S.) per tree in 1978. This seems to be a reasonable investment in street trees worth, on average, over $300 each.

The type of information to be recorded includes:

- date of survey
- number and street address
- location of tree
- height, diameter, crown spread
- species of tree (and/or variety)
- condition and required maintenance for:
  - roots
  - trunk and
  - branches
- immediacy of need for maintenance
- need for tree removal and
- location of spaces where planting is needed.

Coding and computerization of information is common and permits rapid retrieval and updating of data. However, access to a computer is not a prerequisite for conducting an inventory. Card file systems are available which are quite adequate for organizing and retrieving data. Alternately, computer services are available from many private firms, including landscape architects and arborists.

Appendix D

Tree Protection Policies

The following are policies from official plans and other documents and are examples of the types of wording which have been applied to tree protection. The sources are random, not exhaustive.

Official Community Plans

Central Saanich

- To minimize road requirements and impact on tree cover, Council shall encourage clustered development in areas designated Upland.
- To encourage the recognition and protection of heritage properties and trees within the Municipality.
- Council may, by by-law, establish a Municipal heritage advisory committee to advise Council on the protection and conservation of heritage property and trees within the Municipality.
- No person shall remove a tree, demolish a building or structure, alter the façade or exterior of a building or structure, or build on land, designated as a Municipal heritage site without the prior approval, by resolution, of the Council.

Resort Municipality of Whistler

- Private landowners and public agencies should be encouraged to undertake reforestation and reclamation projects to maintain and improve the visual attractiveness of the landscape.

District of Saanich

- Control the removal of vegetation by the adoption of a Tree Protection By-law.
- Require that all development and subdivision applications respect the biophysical characteristics of the site.
- Investigate the possibility of providing economic incentives to preserve hedgerows and to rehabilitate vegetation along watercourses to protect wildlife corridors and water quality.

Official Settlement Plans

Metchosin - Capital Regional District

- Clear cutting of wooded areas for purposes other than the preparation of land for agricultural production is to be discouraged and, where possible, opportunities are to be taken to incorporate wooded areas into plans for new development.
- Regulatory by-laws should encourage clustering of residential development and prescribe guidelines for this purpose in order to preserve mature trees and other natural features in an undisturbed state within and around housing clusters.

Cranbrook Rural Official Settlement Plan (Draft) - Regional District of East Kootenay

Objective: A community that recognizes and benefits from the advantages of retaining natural vegetation.

Policy: It is a general policy of this plan that development design and patterns shall retain as much natural vegetation as possible, short of potential hazard from windblown trees, but furthermore that the well-being of natural vegetation itself be maintained or enhanced wherever possible.

Glen Lake Secondary Plan - Capital Regional District

Objective: To encourage the preservation of the existing trees on private and public properties in the Glen Lake Area.

Policies: Existing trees on undeveloped boulevards should be maintained in a natural state, where possible.

The cutting of existing natural forest trees in excess of 6 inches diameter or 16 feet in height on private or public properties should be restricted.

Clear cutting of trees in new development areas should be restricted. Subdivision and housing should encourage the maximum protection of trees.

Goals for Vancouver

- That trees, flowers, and natural greenery be part of the landscaping in all parts of the city.
- [That] tree planting [be] carried out in such a way that significant views are enhanced, not obscured.
- Eight other policies on trees and landscape.

Glossary

arboriculture: The propagation, care, maintenance and cultivation of individual trees and shrubs.

boulevard trees: Community trees growing on public rights-of-way bordering streets.

community trees: Trees growing in or near a town, city, or other human settlement on private or public property, which contribute to the character of the community.

forest trees: Continuous large stands of native trees, removed from communities, growing with little or no maintenance.

heritage trees: Community trees having exceptional value due to location, scarcity, historical interest, unusual shape, size or age.

street trees: See **boulevard trees.**

urban forest: A large, relatively continuous treed area of public or private land, in or near a community, managed for its multiple use forest values with a strong recreational component.

urban forestry: The planning, establishment, protection and management of trees and associated plants, individually, in small groups, or under forest conditions within cities, their suburbs and towns. (Cooperative Forestry Assistance Act of 1978)

Bibliography

Journals

Journal of Arboriculture, official journal of the International Society of Arboriculture:

- Black, M. *"Tree Vandalism: Some Solutions"*. 4(5) May, 1978.
- Hager, B. *"Street Tree Policies in Ohio Towns"*. 6(7) July, 1980.
- Kielbaso, J. *"Evaluation of Trees in Urban Areas"*. 5(3) March, 1979.
- Massey, J. *"The Economics of Urban Tree Inventories: Fort Worth, A Case Study"*. 5(10) October, 1979.
- McDermott, T. *"The Charlotte Tree Program"*. 5(8) August, 1979.
- Sacksteder, C. *"A Management System for Municipal Trees"*. 5(7) July, 1979.
- Schafer, E. *"Urban Forestry, Its Scope and Complexity"*. 5(9) September, 1979.
- Whitcomb, C. *"Factors Affecting the Establishment of Urban Trees"*. 5(10) October, 1979.

Journal of Forestry:

- Behlen, D. *"Big Trees: Something to Look For"*. 6:2 February, 1980.
- Nobles, B. *"Urban Forestry/Arboriculture Programs"*. 6:2 February, 1980.
- Roberts, B. *"Trees as Biological Filters"*. 6:1 January, 1980.

American Horticulturalist:

- Warren, W.H. *"Street Trees in the Northwest"*. Winter, 1977.

Books and Pamphlets

Andresen, J.W. and J. Swaigen. *Urban Tree and Forest Legislation in Ontario*. Sault Ste Marie: Environment Canada, August, 1978.

Model Tree Bylaws for Canadian Municipalities. Concord: Ontario Shade Tree Council, 1977.

Arnold, Henry F. *Trees in Urban Design*. N.Y.: Van Nostrand Reinhold, 1980.

Baumgartner, R.J. ed. *Tree Planting in the Inland Northwest*. Washington State University, 1976.

Brigstocke, N. "Have You Planted a Tree Lately?" *Habitat*. Vol. 22 No. 1, 1979.

Cole, Trevor. *Planting Trees and Shrubs*. Ottawa: Dept. of Agriculture, Information Division, 1979.

Cook, David. *Suburban Noise Control with Plantings and Solid Barrier Combinations*. University of Nebraska and U.S. Forest Service, 1977.

Coronation Planting Committee. *The Royal Record of Tree Planting*. Cambridge University Press, 1939.

Council of Tree and Landscape Appraisers. *Guide for Establishing Values of Trees and Other Plants*. International Society of Arboriculture, 1979.

Gardner, Robin. "A Management Model for Street Trees in the Urban Pacific Northwest." *Pacific Northwest Trees*. 1:1 March, 1980.

Grey, Gene W. *Urban Forestry*. N.Y.: Wiley, 1978.

Haller, John M. *Tree Care*. 1st ed. Indianapolis: T. Audel, 1977.

Harper, David and Gerry Chaster. *Vegetation and Development*. District of Saanich, 1975.

City of Mississauga, Ontario. *Mississauga Landscape Approval Requirement*. January, 1976.

Nadel, Ira Bruce. *Trees in the City*. N.Y.: Pergamon Press, 1977.

Borough of Scarborough, Ontario. *Site Plan Approval*.

City of Vancouver Planning Department. *Downtown Guidelines*. May, 1977.

Puget and Eddington Lands Development Plan and Design Guidelines. October, 1980.

City of Waterloo, Ontario. *Landscaping Guidelines for Industrial Development*. November, 1976.

District of West Vancouver. *The Tree Book: A Descriptive List of 140 Trees and Large Shrubs That Will Not Exceed An Ultimate Height of 35 Feet*. 1980.

Wyman, D. *Trees for American Gardens*. N.Y.: McMillan.